Il Colle di Galileo

Activity report for the second Pietro Baracchi conference "The era of collaborative multi-wavelength and multi-messenger astronomy: science and technology"

22-24 October 2019, Auditorium Folco Portinari, Fondazione Cassa di Risparmio di Firenze (Italy)

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Introduction

After the success of the first Pietro Baracchi conference, "Italo-Australian Radio Astronomy in the Era of the SKA" held on 1-4 November 2016 in Perth (Western Australia), a second edition was organized for 22-24 October 2019 in Florence (Italy) to encourage closer collaboration between Italy and Australia in astrophysics and supporting technologies. This series of conferences is named in honour of Pietro Paolo Giovanni Ernesto Baracchi (1851 - 1926), an Italian who played a central role in Australian astronomy in the late 1800s and early 1900s. This conference was financially supported by Curtin University and INAF and was attended by around 60 researchers: 70% from Italy and 30% from overseas. The gender balance of the participants was 66% male and 34% female, while the invited speakers were almost 50/50.

ISSN 2281-7727 (print)
ISSN 2281-9711 (online)
Vol. 9, 1, 2020, pp. 71-75
DOI: 10.36253/cdg-11646
www.fupress.com/cdg

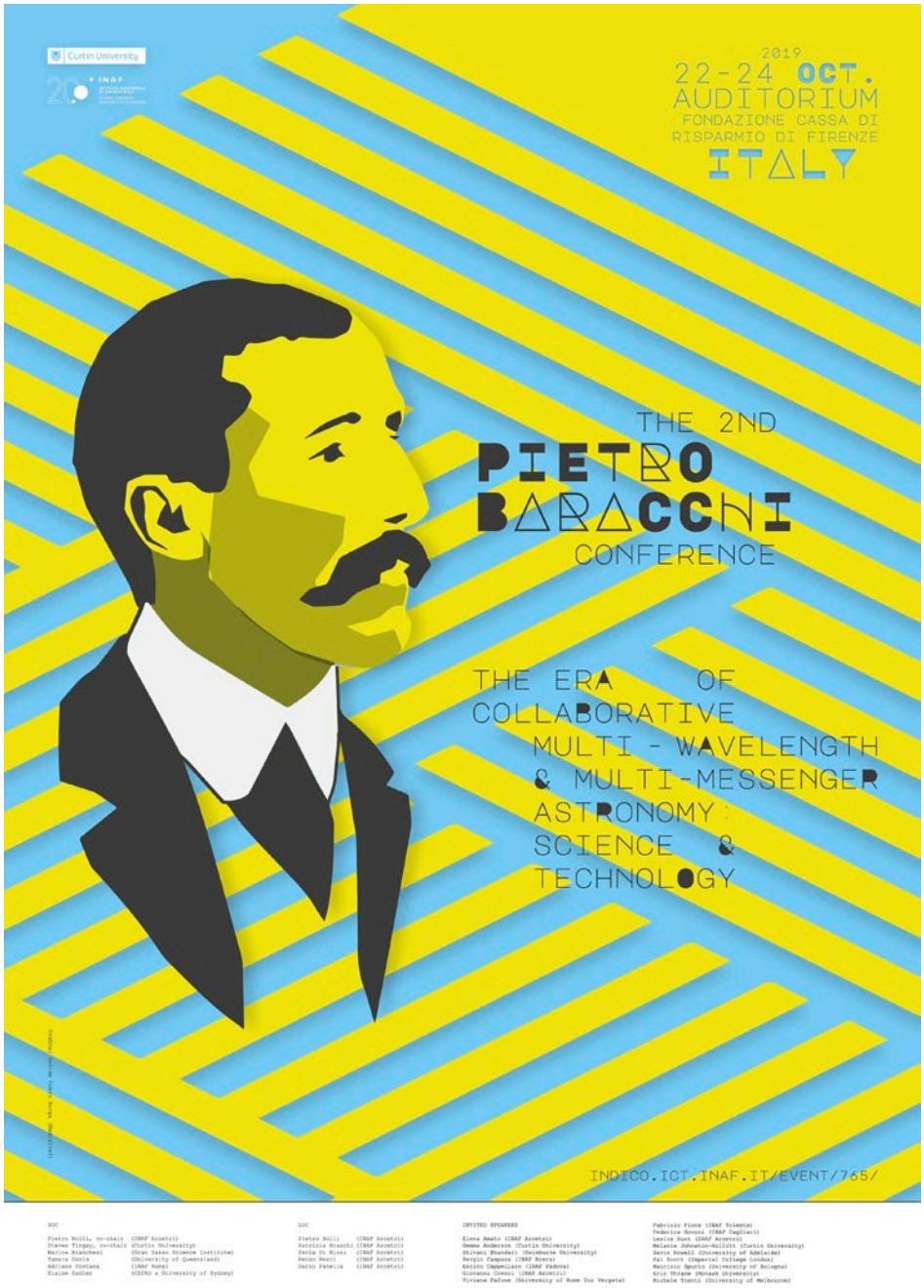

Figure 1. Conference poster. Credit: Davide Coero Borga (Media INAF).

Rationale

Italy and Australia are deeply involved in many of the most advanced next-generation astronomical facilities. Australia and Italy contribute to these facilities at fundamental technological and scientific levels and all of these facilities will play a role in the new era of multi-wavelength and multi-messenger astrophysics and cosmology. With the detection of gravitational waves and the identification of their electromagnetic counterparts, along with the rise of synergies between astroparticle physics and electromagnetic astronomy, our communities face exciting advances, but also technological challenges and challenges in coordination and collaboration. The intention of this meeting is to bring together Italian and Australian astronomers and engineers working across projects and facilities of common interest, with a particular focus on multi-messenger, multi-wavelength astrophysics and cosmology.

Scientific programme

The conference programme, together with the book of abstracts and the presentations, are available on the conference website: https://indico.ict.inaf.it/event/765/.

On the first day of the conference, participants were welcomed by the INAF - Arcetri Astrophysical Observatory Director, Sofia Randich, who also offered greetings from the INAF President, Nicolò D'Amico. Enthusiastic best wishes for a fruitful conference were also delivered by the Australian Ambassador to Italy, Greg French.

The 33 scientific talks were divided into seven scientific sessions:

- *Current and future optical facilities in the multi-messenger era.* The spectrograph SOXS for NTT and the imager and spectrograph MAVIS for VLT were presented by INAF researchers, while two Australian delegates showed some recent results obtained with ASKAP on HI absorption and the SkyHopper CubeSat, a mission concept for an Australian-Italian space telescope.
- *Multi-wavelength and transient astronomy.* This session started with a discussion on the recent increase in the number of transient detections and the potential of new multi-messenger astrophysics. Then, the session focused on transient radio astronomy, with a couple of talks centred on Fast Radio Bursts, their latest discoveries with Parkes and ASKAP radio telescopes, and the multi-wavelength follow-up.
- *The role of current and future radio telescopes in the multi-messenger era*. A total of 13 talks characterized this session, with several different topics combining technology and science. New perspectives on the roles of the radio telescopes from both countries and new frontiers in technology for radio astronomy, including phased array feed and a drone-based system for antenna measurements, were

Figure 2. Conference photo. Credit: Dario Panella (INAF-OAA).

described. The session also covered extensive scientific topics, such as Gamma-Ray Bursts observed through dust and gas in host galaxies, AGN detected at two opposite extremes of the EM spectrum and multi-frequency observations of extra-galactic sources. Several talks focused on the recent impressive results coming from the Australian SKA Pathfinder, ASKAP. Finally, the work at the Medicina Northern Cross radio telescope for the detection of FRB was presented.

- *Gravitational wave detectors and prospects for coordination with electromagnetic astronomy*. This session featured a couple of discussions on Pulsar Timing Arrays and transient astronomical events to investigate gravitational waves, with two more presenting their direct detection with LIGO and Virgo and their impact on analysing the population properties of merging compact binaries.
- *The history of astronomy between Australia and Italy, motivated by the career of Pietro Baracchi*. This session hosted a talk on the discovery by P. Baracchi of a number of nebulae with the Great Melbourne Telescope.
- *The role of astroparticle experiments in the future*. A couple of talks, one from each country, characterized this session: one was more experimental, focusing on the neutrino telescopes in the Mediterranean sea, while the other looked at a programme of multi-messenger joint analysis of particle and astroparticle datasets.
- *High photon energy astrophysics in the multi-messenger era*. This session began with a talk on cosmic ray physics in the CTA era, followed by two scientific

topics: the connection between radio waves and gamma-rays in extreme astronomical settings and the rapid response to radio follow-up of high-energy astrophysical events. Three more technological talks completed the session: the ASTRI mini-array, nano-satellites for high energy astrophysics and fundamental physics and, lastly, the space mission candidate for an M5 mission, THESEUS.

Conclusions

Gavin Rowell and Tiziana Venturi drafted the conclusion of the conference noticing that Italian/Australian astronomical communities are closely linked by numerous projects, while other new collaborations could be triggered in the follow-up to this bi-lateral conference. The impact of multi-wavelength and multi-messenger approaches to astrophysics, which rely heavily on cooperation and collaboration, is now the focus of considerable attention. Everybody was invited to take part in the third Baracchi conference, to be held in Melbourne in 2021.